ISSN (print) 0093-4666 © 2014. Mycotaxon, Ltd. ISSN (online) 2154-8889

MYCOTAXON

http://dx.doi.org/10.5248/129.421

Volume 129(2), pp. 421–427 *October–December 2014*

Galerella xalapensis sp. nov. found in an urban green area in Xalapa, Veracruz, Mexico

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Abstract — While monitoring species diversity of urban green areas in Xalapa city (Veracruz, Mexico), a new species of *Galerella* was found in an abandoned urban green area. After macro- and microscopic analysis it is proposed as a new species, *Galerella xalapensis*, characterized by a faintly plicate-sulcate dry pale grayish brown pileus, white to yellowish glabrous stipe, thick-walled rusty-brown ellipsoid basidiospores, utriform cheilocystidia, and clampless hyphae. The new taxon is described and illustrated, and a comparison with similar species is provided. This is the first *Galerella* recorded from Mexico.

Key words — *Agaricales*, *Bolbitiaceae,* biodiversity, neotropical fungi, taxonomy

Introduction

A core of agaricoid species within the *Bolbitiaceae* (*Agaricales*), related to *Bolbitius* Fr., *Conocybe* Fayod, and *Pholiotina* Fayod, has been recognized as the genus *Galerella* Earle. Although supraspecific relationships derived from molecular phylogenetic analyses have not yet been fully explored, the striking combination of morphological features of the taxa accommodated in *Galerella* led to their characterization by a *Coprinus*-like dry and plicate-sulcate pileus, hymeniform pileipellis, rust-colored basidiospores, and lageniform cheilocystidia (Horak 1968, Pegler 1986, Singer 1986, Hausknecht & Contu 2003). We refer especially to the works of Horak & Hausknecht (2002), Arnolds & Hausknecht (2003), Hausknecht & Contu (2003), and Hausknecht et al. (2004), who not only described new species but also reevaluated the taxonomy of the genus through type studies of earlier named species and integrated informative taxonomic characters to recognize six species currently in *Galerella*. The literature shows that *Galerella* species are rare, but distributed worldwide (Fig. 1). Two widespread species include *G. plicatella* (Peck) Singer, described from USA and reported from Argentina, Brazil, India, Italy, and

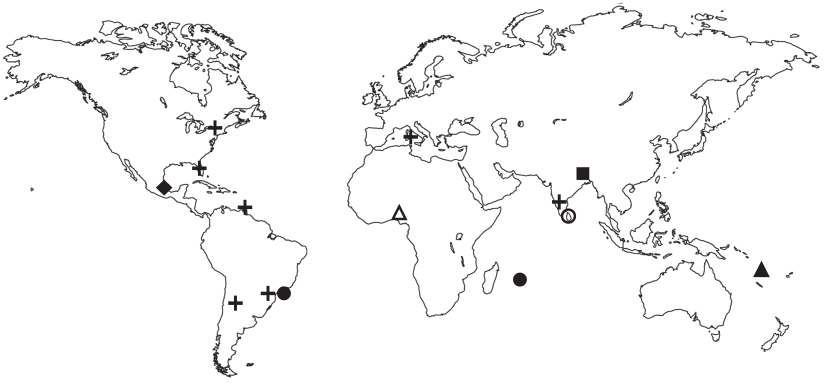

Figure. 1. Representation of the worldwide distribution of *Galerella* species according reports in litt. *G. fibrillosa* (•). *G. floriformis* (▲). *G. microphues* (○). *G. nigeriensis* (△). *G. plicatella* (+). *G. plicatelloides* (▪). *G. xalapensis* (♦).

Trinidad (Dennis 1953, Singer & Digilio 1951, Thomas et al. 2001, Horak & Hausknecht 2002, Hausknecht & Contu 2003, Arnolds & Hausknecht 2003, Hausknecht et al. 2004) and *G. fibrillosa* Hauskn., described from Mauritius and recorded from Brazil (Horak & Hausknecht 2002); but known only from their type localities are *G. floriformis* Hauskn. from Vanuatu, *G. microphues* (Berk. & Broome) Pegler from Sri Lanka, *G. nigeriensis* Tkalčec et al. from Nigeria, and *G. plicatelloides* Sarwal & Locq. from India (Sarwal & Locquin 1983, Pegler 1986, Hausknecht & Contu 2003, Tkalčec et al. 2010).

Recently a bolbitiaceous fungus was found that turned out to represent *Galerella*, a genus previously unrecorded from Mexico. The site is in an abandoned green area, one of multiple points previously established to monitor species diversity of the vascular plants, macrofungi, ants, butterflies, beetles, amphibians, and birds that inhabit urban green areas in Xalapa city (Veracruz, Mexico), a long-term program currently being conducted by a research team of the Instituto de Ecología. After a thorough morphological examination, we concluded that the specimen's unique combination of characters (faintly plicate-sulcate dry pale grayish brown pileus, white to pale yellowish glabrous stipe, thick-walled ellipsoid basidiospores, utriform cheilocystidia, clampless hyphae) confirmed it as an undescribed species of *Galerella*.

Materials & methods

As part of the monitoring program developed in urban green areas from Xalapa city, once a week during June–September 2012 we visited the intra-urban point located at 1230 m alt. south east of Xalapa that corresponds to a heavily disturbed patch of forest formerly used as an orchard. After collecting the single *Galerella* sample in July 2012, we

sampled this point of our sampling mesh daily during May–October 2013 to document thoroughly the fruiting variation of this *Galerella* species. The macroscopic depiction in Pl. 1 is based on field specimens. Macroscopic characters are described from material and microscopic characters were based on dried basidiomata. Color descriptions are according to Kornerup & Wanscher (1967). Tissue sections were mounted in 3% KOH or 1% Congo Red aqueous solution for microscopical examination according to Largent et al. (1977). 110 basidiospores (55 in lateral view and 55 in frontal view) were measured in KOH, and 35 cheilocystidia in Congo Red, basidiospore measurements correspond to length × width in side view × width in frontal view; X = mean length & width values; Q = the mean length/width ratio. Line drawings were made under the microscope, with the aid of a drawing tube. The examined specimen is deposited at XAL herbarium (Thiers B., Index Herbariorum: http://sweetgum.nybg.org/ih/).

Taxonomy

Galerella xalapensis Bandala & Montoya, **sp. nov.** Plate 1

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Differs from other similar species of *Galerella* by its pale grayish brown pileus, white glabrous stipe, narrowly utriform to utriform cheilocystidia, and absence of clamp connections.

Holotype: Mexico. Veracruz: Xalapa, 26 July 2012, Corona 699 (XAL).

Etymology: the epithet refers to Xalapa, the city of origin.

Basidioma slender, delicate, moderately small-sized. Pileus 48–50 mm broad, at first probably broadly convex, becoming plane-depressed or plane-concave, with a weakly raised knob at center, surface pale grayish brown (5D8) irregularly interrupted by paler, almost whitish radial lines, with a darker contrasting area rounding the center, dull, dry, not hygrophanous, faintly plicate-sulcate (*Coprinus*-like) from the disk towards the margin, this latter somewhat undulating. Lamellae narrowly adnate, close, ventricose, whitish to pale grayish, with paler, weakly fimbriate edges. Stipe 150 × 1–1.5 mm, cylindric, almost straight, white, in parts pale yellowish (2.5 Y 8/2), finely and weakly striate, glabrous, dry, fistulose. Context (pileus) very thin (<1 mm thick), whitish (pileus and stipe); odor and taste not distinctive.

Basidiospores 8–11.5(–12.5) × 4.5–6 × 5.5–7(–7.5) µm, ellipsoid in side view, $X = 9.5 \times 5.3$ µm, $Q = 1.80$ µm, broadly ellipsoid, often slightly tapering towards apex and weakly angular at base, then somewhat subhexagonal or subamygdaliform in dorso-frontal view, $X = 9.6 \times 6.1$ µm, ($Q = 1.58$ µm), at times the adaxial side faintly depressed then more or less reniform, thick-walled (<1 µm thick), smooth, with central, more or less truncate germ-pore, reddish-orange, inamyloid, not-dextrinoid. Basidia 16–25 × 8–11 µm, clavate to broadly clavate, 4-spored, some 3-spored, hyaline, thin-walled. Pleurocystidia and Pileocystidia absent. Cheilocystidia 24–48(–55) × 7–20(–22) µm, apex 5–13 µm broad, narrowly utriform to utriform, often

ventricose or with a flexuous neck, occasionally sublageniform, thin-walled, smooth, hyaline, scarce on lamellae edge. Pileipellis hymeniform, composed of clavate to broadly clavate elements 18–35(–38) × 7–12(–13) µm, thin-walled, smooth, easily collapsing, hyaline or with a pale grayish content then in mass the layer appears irregularly pale brownish, inamyloid. Hymenophoral trama regular, made of cylindrical hyphae tightly arranged, hyaline, thin-walled. Pileus trama not recovered, collapsed. Caulocystidia 21–41 × 6–9 µm, more or less similar to cheilocystidia, scarce, occasionally in small groups. Clamp connections absent.

Habitat — Solitary on naked soil, in a small slope of the floor of a green heavily disturbed urban forest patch, with scattered trees (*Eriobotrya japonica* (Thunb.) Lindl., *Fraxinus uhdei* (Wenz.) Lingelsh., *Psidium guajava* L., and *Platanus mexicana* Moric.), shrubs (*Bunchosia lindeniana* A. Juss. and *Solanum nudum* Dunal), and herbs (*Hypoxis decumbens* L., *Paspalum conjugatum* P.J. Bergius, *Acalypha alopecuroides* Jacq., *Desmodium uncinatum* (Jacq.) DC., *Cyperus hermaphroditus* (Jacq.) Standl., and *Rivina humilis* L.).

Distribution — Known only from the type locality in Xalapa.

Remarks — The unique combined set of characters such as the faintly plicate-sulcate dry pale grayish brown pileus, thick-walled ellipsoid basidiospores, narrowly utriform to utriform cheilocystidia, and clampless hyphae distinguish *Galerella xalapensis*. To a certain extent, its habit resembles *G. microphues*, *G. plicatella,* and *G. fibrillosa* but the Mexican species differs strikingly in remarkable important features. *Galerella microphues*, a rather uncommon species restricted to Sri Lanka, is distinguished by narrowly lageniform cheilocystidia (22–35 × 7–9 µm) with a long tapering neck (10–20 × 1.5–2 µm), pyriform (16–25 × 11–16 µm) pileipellis elements, and clamped hyphae (Pegler 1986). The most frequently encountered species (per Horak 1968, Hausknecht & Contu 2003, Hausknecht et al. 2004, Thomas et al. 2001), *G. plicatella* is easily diagnosed by its brown pileus with alternating regions of pale orange, yellowish or fulvous-brown that turns alutaceous-buff with an orange-apricot disc, pale orange lamellae, finely pubescent orange-white stipe, ventricose or lageniform cheilocystidia with a remarkably slender long neck and measuring 30–50 × 6–11 µm, 16.5–54 × 8–16.5 µm, or 20–50 × 6.5–10 µm, and clamped hyphae. *Galerella fibrillosa* — known only from the holotype collected on soil in Mauritius and another specimen from Brazil gathered on a decayed twig — is readily separated by its small fragile basidiomata (pileus 7–15 mm; stipe 30–40 × 0.5–0.8 mm), a conspicuously crenate and fibrillose pale yellow-brown pileus with yellowish ochre or pale brown disc, rapidly deliquescent pale brown to yellowish brown lamellae, vesiculose cheilocystidia (28–)32–55(–62) × 10–20 µm with more or less distinctive papilla to lageniform with elongate cylindrical

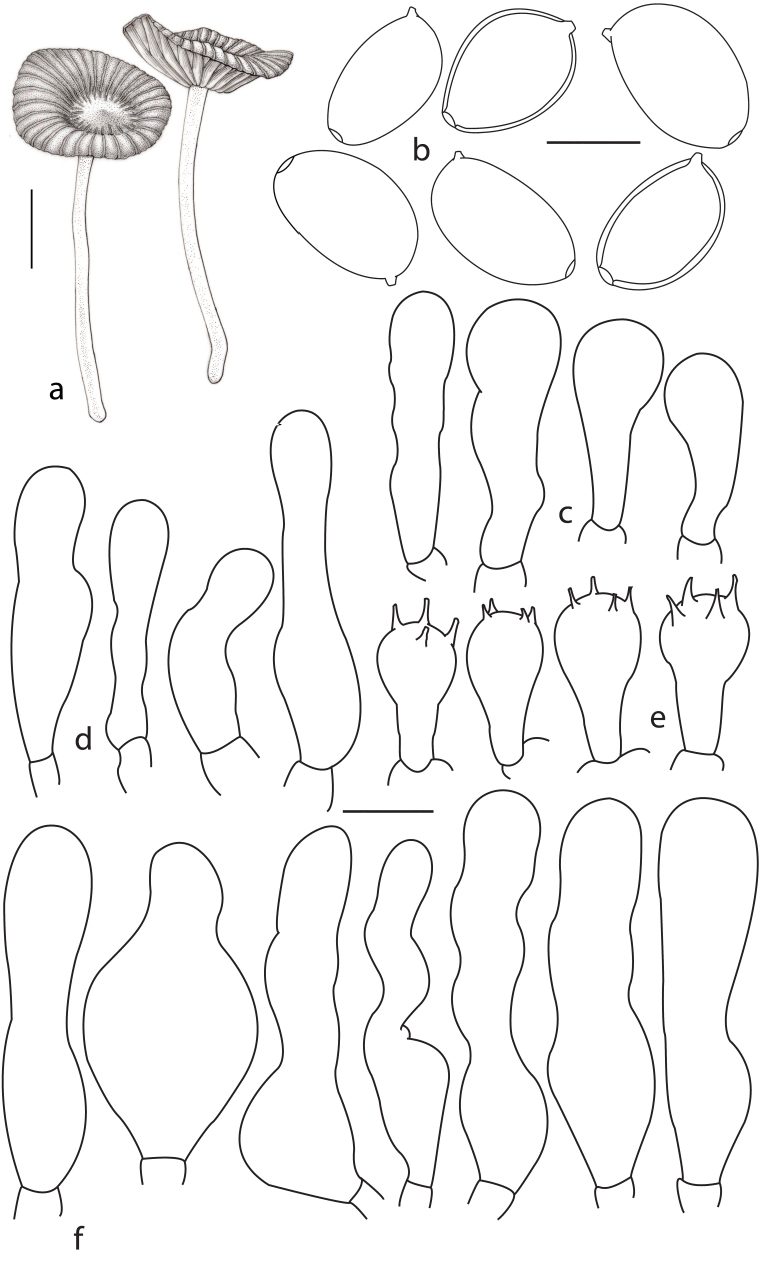

Plate 1. *Galerella xalapensis* (holotype, XAL Corona 699). a. Basidiomata. b. basidiospores. c. elements of pileipellis. d. caulocystidia. e. basidia. f. cheilocystidia. Bars: a = 25 mm; b = 5 µm; c–f = 10 µm.

neck, and clamped hyphae (Horak & Hausknecht 2002). The remaining three known *Galerella* species also differ: *G. plicatelloides* and *G. floriformis* can be recognized by their fertile lamellae edges (i.e., cheilocystidia absent) and *G. nigeriensis* by its strongly plicate-sulcate pale yellowish brown to light orange brown pileus, pubescent stipe, tibiiform to lageniform cheilocystidia, and presence of hymenophysalides (Sarwal & Locquin 1983, Hausknecht & Contu 2003, Tkalčec et al. 2010).

It is important to mention that *G. xalapensis* may have a particular fruiting pattern, judging by the behavior observed in the sampled site. After a single collection appeared in July 2012, we increased our sampling frequency to once a week during August–September 2012, during which we found no basidiomata of *G. xalapensis*. Although we visited the site daily during May–October 2013, we never again observed specimens of this *Galerella* species. The question is whether *G. xalapensis* represents a fungal group that fluctuates in occurrence and abundance, not fruiting for several consecutive months or years but remaining in place as a physiologically active mycelium, or whether it suffers from disturbance, so that finding a specimen at the site was a matter of chance and good fortune. A similar example is represented by *G. nigeriensis*, which was collected at the edge of a heavily disturbed secondary tropical forest (Tkalčec et al. 2010). Given that we continue to monitor the study site thoroughly and recognizing that the specimen combines a striking set of taxonomic characters, we decided to propose the new species here. Nonetheless, we will continue to monitor the type locality for *G. xalapensis* and other agaricaceous fungi as part of our sampling program in Xalapa's urban green areas.

Acknowledgments

We thank INECOL for the financial seed grant to support the monitoring program in the urban green areas in Xalapa. We appreciate the collaboration in the monitoring of macrofungi in the field of the biologists J.C. Corona and D. Ramos, this latter also assisted us during the microscopic study. Special thanks to E. Saavedra for elaborating the line drawing of the basidiomata and Dr. L. Lorea for the plants information from the site studied (all at INECOL). We acknowledge the valuable revision and comments on the manuscript by Dr. A. Hausknecht (Austrian Mycological Society) and Dr. I. Krisai-Greilhuber (University of Vienna). Especial thanks to Dr. S. Pennycook and Dr. L. Norvell for their meticulous revision and improving the text.

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